

TRIBHUVAN UNIVERSITY

Institute of Science and Technology

2065

Bachelor Level/ First Year/ First Semester/ Science

Computer Science and Information Technology (STA-103)

(Probability and Statistics)

Full Marks: 60

Pass Marks: 24

Time: 3 hours.

Candidates are required to give their answers in their own words as far as practicable.

All notations have the usual meaning.

Group A

Attempt any Two:

(2x10=20)

1. Show that the mean and variance of Poisson distribution are equal. Telephone calls enter a college switchboard on the average of two every 3 minutes. If one assumes an appropriate Poisson process, what is the probability of three or more calls arriving in a 9-minute period?
2. Differentiate between confidence level and level of significance. A manufacturer of flashlight batteries took a sample of 10 batteries from a day's production and used them continuously until they failed to work. The life is measured by the number of hours until failure was:
34 42 31 54 26 45 63 51 26 56
At the 0.05 level of significance, is there evidence that the mean life of the batteries is different from 40 hours?
3. A chemical company, wishing to study the effect of extraction time on the efficiency of an extraction operation, obtained the data shown in the following table:

Extraction time in minute (X)	27	45	41	19	35	39	19
Extraction efficiency in % (Y)	57	64	80	46	62	72	52

- (a) Fit a straight line to the given data by the method of least squares and use it to predict the extraction efficiency one can expect when the extraction time is 35 minutes.
- (b) Determine the coefficient of determination and interpret its meaning.

Group B

Answer any eight questions:

(8x5=40)

4. The following are the numbers of minutes that a person had to wait for the bus to work on 15 working days: 10, 1, 13, 9, 5, 9, 2, 10, 3, 8, 6, 17, 2, 10 and 15. Find mean, median, mode and describe the shape of the distribution.

5. The probability that an integrated circuit chip will have defective etching is 0.12, the probability that it will have a crack defect is 0.29, and the probability that it has both defects is 0.07. What is the probability that a newly manufactured chip will have either an etching or a crack defects.
6. An importer is offered a shipment of machine tools for Rs. 140,000, and the probabilities that he will be able to sell them for Rs. 180,000, Rs. 170,000 or Rs. 150,000 are 0.32, 0.55 and 0.13 respectively. What is the Importer's expected gross profit?
7. If two random variables have the joint density

$$f(x, y) = \begin{cases} \frac{6}{5}(x + y^2) & \text{for } 0 < x < 1, 0 < y < 1 \\ 0 & \text{elsewhere} \end{cases}$$

Find the probability that $0.2 < X < 0.5$ and $0.4 < Y < 0.6$.

8. It is believed that 80% of Nepalese do not have any health insurance. Suppose this is true and let X equal the number with no health insurance in a random sample of $n = 12$ Nepalese.
 - (a) Write the probability model of X ?
 - (b) Give the mean and variance of X ?
 - (c) Find $P(X > 2)$.
9. Given a random variable having the normal distribution with $\mu = 16.2$ and $\sigma^2 = 1.5625$, find the probabilities that it will take on a value (i) greater than 16.8, (ii) less than 14.9 and (iii) between 13.6 and 18.8.
10. Define canonical definition of Chi square distribution and write its density function and its some properties.
11. Obtain the maximum likelihood estimate for the parameter π (proportion of success) of binomial distribution.
12. The average zinc concentration recovered from a sample of zinc measurements in 36 different locations is found to be 2.6 grams per millimeter. Find the 95% confidence interval for the mean zinc concentration. Assume that the population standard deviation is 0.3
13. Explain the purpose of regression analysis. State model and assumption of simple linear regression.